Claims

1. A method of noise reduction comprising:

sampling an audio signal at a sample rate f;

converting the audio signal to a digital signal in time domain;

for each of a series of frames of time, converting the digital signal in the time domain to a digital signal in frequency domain for the frame of time;

wherein the converting includes determining a set of frequency domain values, the frequency domain values in the set created by a set of digital filters, the digital filters related to each other by a constant ratio of filter bandwidth to center frequency, related to a perceptual scale for auditory processing;

obtaining a set of minimum magnitude frequency domain values including, at each frequency represented by the frequency domain values, a frequency domain value having a minimum magnitude from among frequency domain values for such frequency over a time interval spanning multiple frames of time;

subtracting the set of minimum magnitude frequency domain values from the audio signal in frequency domain, for a particular frame of time;

converting the subtracted audio signal to time domain; and

outputting the converted audio signal.

2. The method of claim 1, wherein the particular frame of time comprises the current frame of time.

3. The method of claim 1, wherein each frame of time comprises a time span in the range of 10 to 50 milliseconds.

4. The method of claim 1, wherein the time interval spanning multiple frames comprises an interval in a range from 0.25 second to 2 seconds.

5. The method of claim 1, wherein the minimum magnitude frequency domain values are first multiplied by a gain that is greater than unity.

6. The method of claim 1, wherein the subtracted audio signal is compared to a threshold, the threshold being greater than or equal to zero, the threshold being related to a scaled version of the original audio signal, and the greater of the two being used for the conversion to the time domain.

7. The method of claim 1, wherein the subtracted audio signal is modified in a non-linear fashion, by exponentially increasing its magnitude, in order to sharpen the spectral maximums and reduce the spectral minimums.

8. A system comprising:

a set of digital filters, the digital filters related to each other by a constant ratio of filter bandwidth to center frequency, related to a perceptual scale for auditory processing; and

a mechanism that

samples an audio signal at a sample rate f;

converts the audio signal to a digital signal in time domain;

for each of a series of frames of time, converts, using the set of digital filters, the digital signal in the time domain to a digital signal in frequency domain for the frame of time;

obtains a set of minimum magnitude frequency domain values including, at each frequency represented by the frequency domain values, a frequency domain value having a minimum magnitude from among frequency domain values for such frequency over a time interval spanning multiple frames of time;

subtracts the set of minimum magnitude frequency domain values from the audio signal in frequency domain, for a particular frame of time;

converts the subtracted audio signal to time domain; and

outputs the converted audio signal.

9. The system of claim 8, wherein each frame of time comprises a time span in the range of 10 to 50 milliseconds.

10. The system of claim 8, wherein the time interval spanning multiple frames comprises an interval in a range from 0.25 second to 2 seconds.

11. The system of claim 8, wherein the minimum magnitude frequency domain values are first multiplied by a gain that is greater than unity.

12. The system of claim 8, wherein the subtracted audio signal is compared to a threshold, the threshold being greater than or equal to zero, the threshold being related to a scaled version of the original audio signal, and the greater of the two being used for the conversion to the time domain.

13. The system of claim 8, wherein the subtracted audio signal is modified in a non-linear fashion, by exponentially increasing its magnitude, in order to sharpen the spectral maximums and reduce the spectral minimums.

14. The system of claim 8, wherein the mechanism selectively performs the subtraction.

15. The system of claim 8, wherein the subtraction is performed based on whether noise is expected.

16. The system of claim 8, wherein the subtraction is applied if mechanical mechanism of the system is active.

17. A recording device comprising:

an audio input mechanism;

a mechanism that records on a recording medium;

a set of digital filters, the digital filters related to each other by a constant ratio of filter bandwidth to center frequency, related to a perceptual scale for auditory processing; and

a mechanism that

samples an audio signal received from the audio input mechanism at a sample rate f;

converts the audio signal to a digital signal in time domain;

for each of a series of frames of time, converts, using the set of digital filters, the digital signal in the time domain to a digital signal in frequency domain for the frame of time;

obtains a set of minimum magnitude frequency domain values including, at each frequency represented by the frequency domain values, a frequency domain value having a minimum magnitude from among frequency domain values for such frequency over a time interval spanning multiple frames of time;

subtracts the set of minimum magnitude frequency domain values from the audio signal in frequency domain, for a particular frame of time;

converts the subtracted audio signal to time domain; and

records the converted audio signal on the recording medium.

18. The system of claim 17 including a mechanical mechanism that produces noise, wherein the subtraction is applied if mechanical mechanism of the system is active.

19. A multi-media recording device comprising:

an audio input mechanism;

a device that receives a visual image;

a mechanism that records on a recording medium;

a set of digital filters, the digital filters related to each other by a constant ratio of filter bandwidth to center frequency, related to a perceptual scale for auditory processing; and

a mechanism that

samples an audio signal received from the audio input mechanism at a sample rate f;

converts the audio signal to a digital signal in time domain;

for each of a series of frames of time, converts, using the set of digital filters, the digital signal in the time domain to a digital signal in frequency domain for the frame of time;

obtains a set of minimum magnitude frequency domain values including, at each frequency represented by the frequency domain values, a frequency domain value having a minimum magnitude from among frequency domain values for such frequency over a time interval spanning multiple frames of time;

subtracts the set of minimum magnitude frequency domain values from the audio signal in frequency domain, for a particular frame of time;

converts the subtracted audio signal to time domain; and

records the converted audio signal on the recording medium.

20. The multimedia device of claim 19, wherein the visual image is recorded on the recording medium.

21. The system of claim 19 including a mechanical mechanism that produces noise, wherein the subtraction is applied if a mechanical mechanism of the system is active.

22. The system of claim 21 wherein the mechanical mechanism comprises a lens zoom mechanism.

23. A playback device comprising:

an output mechanism;

a mechanism that reads from a recording medium;

a set of digital filters, the digital filters related to each other by a constant ratio of filter bandwidth to center frequency, related to a perceptual scale for auditory processing; and

a mechanism that

samples an audio signal received from the recording medium at a sample rate f;

converts the audio signal to a digital signal in time domain;

for each of a series of frames of time, converts, using the set of digital filters, the digital signal in the time domain to a digital signal in frequency domain for the frame of time;

obtains a set of minimum magnitude frequency domain values including, at each frequency represented by the frequency domain values, a frequency domain value having a minimum magnitude from among frequency domain values for such frequency over a time interval spanning multiple frames of time;

subtracts the set of minimum magnitude frequency domain values from the audio signal in frequency domain, for a particular frame of time;

converts the subtracted audio signal to time domain; and

outputs the converted audio signal on the output mechanism.

24. The playback device of claim 23, including a mechanism that plays video.

25. The playback device of claim 23, wherein the output mechanism includes a speaker.

26. A communications device comprising:

an input;

a set of digital filters, the digital filters related to each other by a constant ratio of filter bandwidth to center frequency, related to a perceptual scale for auditory processing; and

a mechanism that

samples an audio signal received from the input at a sample rate f;

converts the audio signal to a digital signal in time domain;

for each of a series of frames of time, converts, using the set of digital filters, the digital signal in the time domain to a digital signal in frequency domain for the frame of time;

obtains a set of minimum magnitude frequency domain values including, at each frequency represented by the frequency domain values, a frequency domain value having a minimum magnitude from among frequency domain values for such frequency over a time interval spanning multiple frames of time;

subtracts the set of minimum magnitude frequency domain values from the audio signal in frequency domain, for a particular frame of time;

converts the subtracted audio signal to time domain; and

outputs the converted audio signal.

27. The system of claim 26 including a radio tuner.

28. The system of claim 26 including mobile telephone receive and transmit electronics.